to thousands of Londoners owing to the impossibility of reaching them without struggling through narrow and mean streets and roads."

The first chapter of Mr. Robinson's book opens with a consideration of the Bois de Boulogne, and from it we may learn much that is good both in the way of artistic grouping, planning, and in the selection of individual plants. Unlike what we too often see in public parks and gardens, the vegetation along the banks of the lakes in the Bois is properly diversified, "so that at one place we meet with conifers, at another rock shrubs, at another magnolias, and so on, without the eternal repetition of common things which one too often sees." The author next proceeds to point out the great advantage of permanent planting over that of plants which show only a fleeting annual display. In spring the early bloom and budding leaves are in themselves things of beauty, and are even more so when seen collectively or in company with each other. In summer they furnish an infinite variety of form and consequent depth of tone, while in autumn "the number and richness of the tints of the foliage afford a varied picture from week to week, and in winter the many graceful forms of the deciduous trees among the evergreen shrubs and pines offer as much to interest an observant eye as at any other season."

On the subject of sub-tropical gardening, which is well exemplified in the Park Monceau, the author writes in his pleasantest manner, as the following extract will show:—"We may be pleased by the wide spread of purple on a heath or mountain, but when we go near and examine it in detail we find that its most exquisite aspect is seen in places where the long moss cushions itself beside the Ling, and the fronds of the Polypody peer forth around little masses of heather. Everywhere we see nature judicious in the arrangement of her highest effects, setting them in clouds of verdant leafage, so that monotony is rarely produced—a state of things which it is highly desirable to attain, as far as possible, in the garden. We cannot attempt to reproduce this literally, nor would it be wise or convenient to do so; but assuredly herein will be found the chief source of true beauty and interest in our gardens; and the more we keep this fact before our eyes the nearer will be our approach to truth and success.

"We should compose from nature, as landscape artists do. We may have in our gardens—and without making wildernesses of them—all the shade, the relief, the grace, the beauty, and nearly all the irregularity of nature. This bold growth of 'fine-foliaged plants' has shown us that one of the greatest mistakes ever made in the garden was the adoption of a few varieties of plants for culture on a vast scale, to the exclusion of interest and variety, and too often of beauty or taste. We have seen how well the pointed, tapering leaves of the cannas carry the eye upwards; how refreshing it is to cool the eyes in the deep green of those thoroughly tropical castor-oil plants, with their gigantic leaves, how noble the Wigandia, with its fine texture and massive outline looks, after we have surveyed brilliant lines and richly painted leaves; how, too, the bold tropical palm leaves beautify the garden. In a word, the system has shown us the difference between the gardening that interests and delights all beholders, and not the horticulturist only, and that which is too often offensive to the eye of taste and pernicious to every true interest of what has been called 'the purest of human pleasures.'"

Notwithstanding the general interest kept up throughout Mr. Robinson's book, no part is of greater interest than the chapter on the cultivation of mushrooms in the caves under Paris, where, at a depth of from sixty to eighty feet below the surface of the ground, in old stone quarries, this edible fungus is grown systematically on a very large scale. These caves furnish not only the daily supply of the Paris markets, but to a large extent those of England and other countries also, preserved mushrooms to the extent of 14,000 boxes annually being exported to this country by one house alone. It is estimated that in and around Paris the daily production of mushrooms amounts to about twenty-five tons, of the value of about 1,000*l.*, or close upon 400,000*l.* per annum. One large grower near St. Denis is described as employing nineteen horses and fifty men. Mushrooms are very extensively used in France, not only in their fresh state, but preserved in various ways, either by tinning, bottling, preserving in butter or oil, or reducing to powder.

The book is exceedingly well printed and carefully got up.

OUR BOOK SHELF

Elements of Physiography. By Prof. D. T. Ansted, M.A., F.R.S. (Allen and Co.)

WE are glad to see a book on physiography from the pen of Prof. Ansted, whose name has so long been associated with the literature of physical geography. If the new subject, however, is to be treated as it is in the present work, we fail to see the advantage of any change. The distinctive parts of physiography are all got through in an introduction of some eighteen pages, which we fear are too much written up to the *ipsissima verba* of the syllabus issued by the Science and Art Department to be of much educational value.

And, in fact, it is on this point that we find most fault with the book. Take these two paragraphs concerning aqueous vapour, pp. 101, 102, and note the absence of the why in every case.

"Aqueous vapour is frequently rendered visible as mist, fog, or cloud. These are varieties of the same condition. Mist is formed when currents of air of different temperature, both containing invisible vapour, meet near the earth. In valleys such mixtures are very frequent, and in mountainous countries very striking. Fogs are formed in the same way in temperate climates at various seasons, and hang over shores and the mouths of certain streams.

"Clouds are produced when mixtures of currents take place at some distance above the ground, and the visible vapour is entirely detached from the earth. There are several varieties of clouds, some floating at a height of many miles, some hovering in large masses in mid-air, some drooping downwards and almost touching the earth. They are rarely alike long together. They assume, as we know, the most fantastic shapes, and are occasionally decorated with brilliant tints of colour! It is only the clouds that form in large masses and approach the earth that dissolve into heavy and long-continued rain, but all clouds are capable of yielding rain, and drops sometimes, though rarely, fall through air perfectly clear and cloudless."

A student had better not be taught at all than be taught in this manner, and, in fact, a student of average intelligence, after reading such a string of assertions without the least

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attempt at explanation—while everyone of them might have been made part of his nature for ever afterwards, by giving the simple reason in each case—if he does not doubt the competence of his teacher, will have no more to do with him.

La Spectroscopie. By A. Cazin. (Paris: Gauthièr-Villars.)

THE talented author of this work has passed away since the MS. was completed. This is by no means a systematic treatise, but it contains a large amount of information—some of it out-of-the-way information—and it will repay perusal. As much of M. Cazin's information on the celestial applications has been gathered from Secchi's works its complete accuracy is not to be relied on, but the explanation given of the different methods employed is very clear.

The part of the book which perhaps will be read with the greatest interest is that dealing with radiation and absorption spectra. In this part the author includes a notice of much of his own work, which is of great interest and importance. The *historique* of the question as to the existence of double or multiple spectra is interesting, and the author's leaning is against the view held by Ångström and Thalèn. He gives special observations of his own concerning nitrogen, and indeed was engaged on an extension of them at the time of his lamented death.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Sun-spots and Rainfall

IF the sun-spot cycles were all of the same length the simplest way of comparing the yearly sun-spot areas with the yearly amounts of rainfall in order to see whether the two phenomena were more or less numerically related, would be to find the annual means of the greatest possible number of cycles, care being taken to place the years of maximum and minimum in the same two groups respectively, and the intervening years in due succession. But as the sun-spot cycles are not of the same length, we must in employing the method of arithmetical means, make some modifications calculated to suit the circumstances of the case.

1. We may, for example, take any cycle whatever may be its duration, and commencing with its first and ending with its last year, compare with the sun-spots the rainfall at any station, or the means of the rainfall at a number of stations for the same years.

2. If some of the cycles be of the same length, we may take these alone and compare them with the rainfall, still taking care that the years of maximum and minimum sun-spots shall be respectively in the same groups.

3. The average length of the sun-spot cycle being, as far as is yet known, about eleven years, we may take any number of cycles of different lengths and make two separate comparisons, in one of which the maximum years are to be placed in the same group, and in the other the minimum years in the same group, the number of the other groups preceding and following the epochal groups being determined by the fact that the mean interval from minimum to maximum is about 3·7 years, and from maximum to minimum about 7·4 means.

I have tried these and several other methods, with, I think, considerable success. The method just mentioned (3), which is the old one of arithmetical means somewhat modified to meet the conditions of the case, possesses several advantages, one of the most important of which is that it enables us to compare directly the rainfall with the sun-spots in the epochal years, and in at least two years before and two years after them, thus affording a fair comparison for nearly the whole cycle of eleven years—a most essential point, which, it would appear, has been overlooked by some writers on the subject.

Having in my last communication (NATURE, vol. xvii. p. 448) given an example of the first half of the above method, together with the results obtained by it for several localities, I intended on this occasion to submit only one or two examples of the second half. But finding that the method has been criticised by Mr. Buchan, and having now Prof. Wolf's latest edition of his relative sun-spot numbers, as well as the rainfall of Madras for 1877, it may be proper to give instances of the application of the whole process.

Let us begin with Wolf's relative numbers, which are so arranged in the following table that those for the years of maximum sun-spot, from 1811 to 1877, are all in the sixth line. This table has already been given by Mr. Buchan (NATURE, vol. xvii. p. 506), but as references will be made to it now, and also in future discussions of the rainfalls of various parts of the globe, it is desirable to reproduce it here.

TABLE I.—*Wolf's Sun-spot Numbers* (*Maximum Years in Sixth Line*).

Year.	1811–1823.	1824–1836.	1832–1844.	1843–1855.	1855–1867.	1865–1877.	Means.	Mean Cycle.	Variation.	Year of Cycle.
1	1·6	8·1	26·3	13·1	7·7	31·4	14·7	—	—	—
2	4·9	16·2	9·4	19·3	5·1	14·7	11·6	14·9	−33·9	1
3	12·6	35·0	13·3	38·3	22·9	8·8	21·8	25·4	−23·4	2
4	16·2	51·2	59·0	59·6	56·2	36·8	46·5	48·8	0·0	3
5	35·2	62·1	119·3	97·4	90·3	78·6	80·5	77·0	+28·2	4
6	**46·9**	**67·2**	**136·9**	**124·9**	**94·8**	**131·8**	**100·4**	**91·9**	**+43·1**	**5**
7	39·9	67·0	104·1	95·4	77·7	113·8	83·0	83·0	+34·2	6
8	29·7	59·4	83·4	69·8	61·0	99·7	65·7	65·6	+16·8	7
9	23·5	26·3	61·8	63·2	45·4	67·7	48·0	49·0	+ 0·2	8
10	16·2	9·4	38·5	52·7	45·2	43·1	34·2	34·6	−14·2	9
11	6·1	13·3	23·0	38·5	31·4	18·9	21·9	24·6	−24·2	10
12	3·9	59·0	13·1	21·0	14·7	11·3	20·5	22·5	−26·3	11
13	2·6	119·3	19·3	7·7	8·8	7·0	27·5	—	—	—

It will be seen that each of six of the columns in the above table gives the sun-spot numbers for thirteen years, and that the first term of what is called the "mean cycle" is obtained from the expression, $\frac{a + 2b + c}{4}$, where a, b, c, are the means of the sun-spots for the first, second, and third years of the thirteen years, the remaining terms being obtained in a similar manner. The "variation" is simply the deviations from the mean value of the sun-spots for the "mean cycle."

The next table gives the sun-spot numbers, from 1816 to 1872, arranged so that the minimum years are in the eighth line:—

TABLE II.—*Wolf's Sun-spot Numbers* (*Minimum Years in Eighth Line*).

Year.	1816–1828.	1826–1838.	1836–1848.	1849–1861.	1860–1872.	Means	Mean Cycle.	Variation.	Year of Cycle.
1	46·9	35·0	119·3	95·4	94·8	78·3	—	—	—
2	39·9	51·2	136·9	69·8	77·7	75·1	73·1	+ 23·3	1
3	29·7	62·1	104·1	63·2	61·0	64·0	64·3	+ 14·5	2
4	23·5	67·2	83·4	52·7	45·4	54·4	54·6	+ 4·8	3
5	16·2	67·0	61·8	38·5	45·2	45·7	44·2	− 5·6	4
6	6·1	59·4	38·5	21·0	31·4	31·3	30·8	− 19·0	5
7	3·9	26·3	23·0	7·7	14·7	15·1	17·3	− 32·5	6
8	**2·6**	**9·4**	**13·1**	**5·1**	**8·8**	**7·8**	**12·7**	**− 37·1**	**7**
9	8·1	13·3	19·3	22·9	36·8	20·1	24·4	− 25·4	8
10	16·2	59·0	38·3	56·2	78·6	49·7	51·6	+ 1·8	9
11	35·0	119·3	59·6	90·3	131·8	87·2	80·7	+ 30·9	10
12	51·2	136·9	97·4	94·8	113·8	98·8	94·6	+ 44·8	11
13	62·1	104·1	124·9	77·7	99·7	93·7	—	—	—

We can now compare the rainfall of Madras with the values of the sun-spots in Tables I. and II., except for the years 1811 and 1812, for which there are no observations:—

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